**Samsung Secret**

Product Information

Customer :                                          DATE : Mar. 28．2011

*SAMSUNG TFT-LCD*

MODEL : **LTA320AP05**

*The Information Described in this Specification is Preliminary and can be changed without prior notice*

LCD Business

Samsung Electronics Co . , LTD.

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## Revision History

| Date | Rev. No | Page | Summary |
|------|---------|------|---------|
| Feb.16. 2011 | 000 | all | First issued |

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## General Description

### Description

**LTA320AP05** is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 32.0" is 1366 x 768 and this model can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV

### Features

- RoHS compliance (Pb-free)
- High contrast ratio & aperture ratio with wide color gamut
- PVA (Patterned Vertical Align) mode
- Wide viewing angle (±178°)
- High speed response
- HD resolution (16:9)
- Low Power consumption
- Direct U-Type 4 CCFLs (Cold Cathode Fluorescent Lamp)
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface (1pixel/clock)

### General Information

| Items | Specification | Unit | Note |
|---|---|---|---|
| Module Size | 760(H) X 450 (V) | mm | ±1.0mm |
| | 50.5 (D max) | | With converter |
| Weight | 5,700 (Max) | g | With converter |
| Pixel Pitch | 0.51075 (H) × 0.17025 (V) | mm | |
| Active Display Area | 697.6845 (H) X 392.256 (V) | mm | |
| Surface Treatment | Haze 7, Hard-coating(3H) | | |
| Display Colors | 8 bit – 16.7 M | colors | |
| Number of Pixels | 1366 x 768 | pixel | |
| Pixel Arrangement | RGB vertical stripe | | |
| Display Mode | Normally Black | | |
| Luminance of White | 450 (Typ.) | cd/m$^2$ | |

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# 1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

| Item | Symbol | Min. | Max. | Unit | Note |
|------|--------|------|------|------|------|
| Power Supply Voltage | $V_{DD}$ | 10.8 | 13.2 | V | (1) |
| Storage temperature | $T_{STG}$ | -20 | 65 | ℃ | (2) |
| Operating temperature | $T_{OPR}$ | 0 | 50 | ℃ | |
| Surface temperature | $T_{SUR}$ | 0 | 65 | ℃ | (3) |
| Shock ( non - operating ) | X,Y,Z | - | 50 | G | (4) |
| Vibration ( non - operating ) | $V_{NOP}$ | - | 1.5 | G | (5) |

Note (1) Ta= 25 $\pm$ 2 °C
     (2) Temperature and relative humidity range are shown in the figure below.
         a. 93.8 % RH Max.  (Ta ≤ 39 °C)
         b. Relative Humidity is 93.8% or less. (Ta > 39 °C)
         c. No condensation
     (3) Although abnormal visual problems can be occurred in $T_{SUR}$ range, the polarizer
         is not damaged in this range.
     (4) 20ms, sine wave, one time for $\pm$X, $\pm$Y, $\pm$Z axis
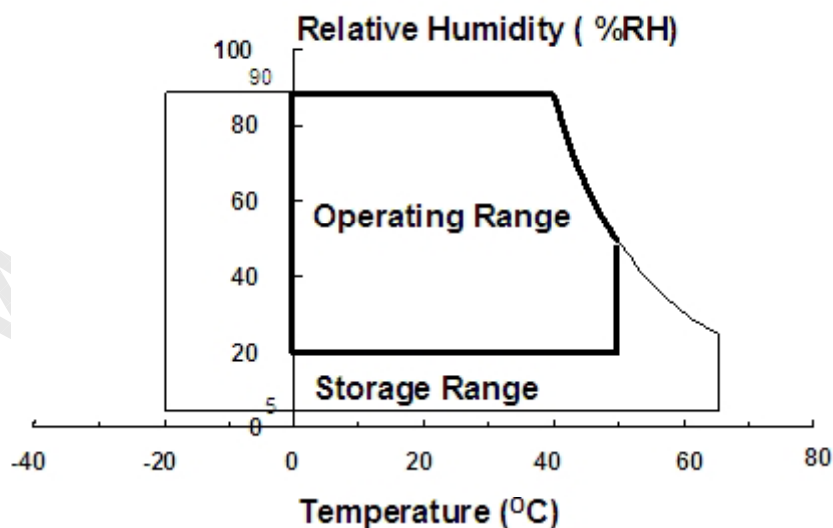     (5) 10-300 Hz, Sweep rate 11min, 30min for X,Y,Z axis

**Fig.  Temperature and  Relative humidity range**

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## 2. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : TOPCON BM-7, TOPCON SR-3, ELDIM EZ-Contrast

(Ta = 25 $\pm$ 2°C,  VDD=12V,   fv= 60Hz,  $f_{DCLK}$ = 75MHz, Lamp current =13.5mA)

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio (Center of screen) | | C/R | | 3000 | 4000 | - | | (1) SR-3 |
| Response Time | G-to-G | Tg | | - | 8 | 16 | msec | (3) BM-7 |
| Luminance of White (Center of screen) | | $Y_L$ | | 400 | 450 | - | cd/m² | (4) SR-3 |
| Color Chromaticity (CIE 1931) | Red | Rx | Normal q**L,R** =0 q**U,D** =0 Viewing Angle | TYP. -0.03 | 0.637 | TYP. +0.03 | | (5),(6) SR-3 |
| | | Ry | | | 0.326 | | | |
| | Green | Gx | | | 0.287 | | | |
| | | Gy | | | 0.610 | | | |
| | Blue | Bx | | | 0.149 | | | |
| | | By | | | 0.058 | | | |
| | White | Wx | | | 0.280 | | | |
| | | Wy | | | 0.290 | | | |
| Color Gamut | | - | | 69 | 72 | - | % | (5) SR-3 |
| Color Temperature | | CCT | | 7,000 | 10,000 | 13,000 | K | |
| Viewing Angle | Hor. | $q_L$ | C/R≥10 | 79 | 89 | - | Degree | (6) EZ-Contrast |
| | | $q_R$ | | 79 | 89 | - | | |
| | Ver. | $q_U$ | | 79 | 89 | - | | |
| | | $q_D$ | | 79 | 89 | - | | |
| White Brightness Uniformity (9 Points or 13Points) | | $B_{uni}$ | | - | - | 25 | % | (2) SR-3 |

- Test Equipment Setup

    The measurement should be executed in a stable, windless and dark room  at least
    60min after lighting the back light at the given temperature for stabilization
    of the back light. This should be measured in the center of screen.

    Environment condition : Ta  = 25 $\pm$ 2 °C

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| Photo detector | Field |
|---|---|
| SR-3 | 1° |
| BM-7 | 2° / 1° |

Photo detector

Field

SR-3 ：50㎝
BM-7 ：50㎝

TFT - LCD Module

LCD Panel

The center of the screen
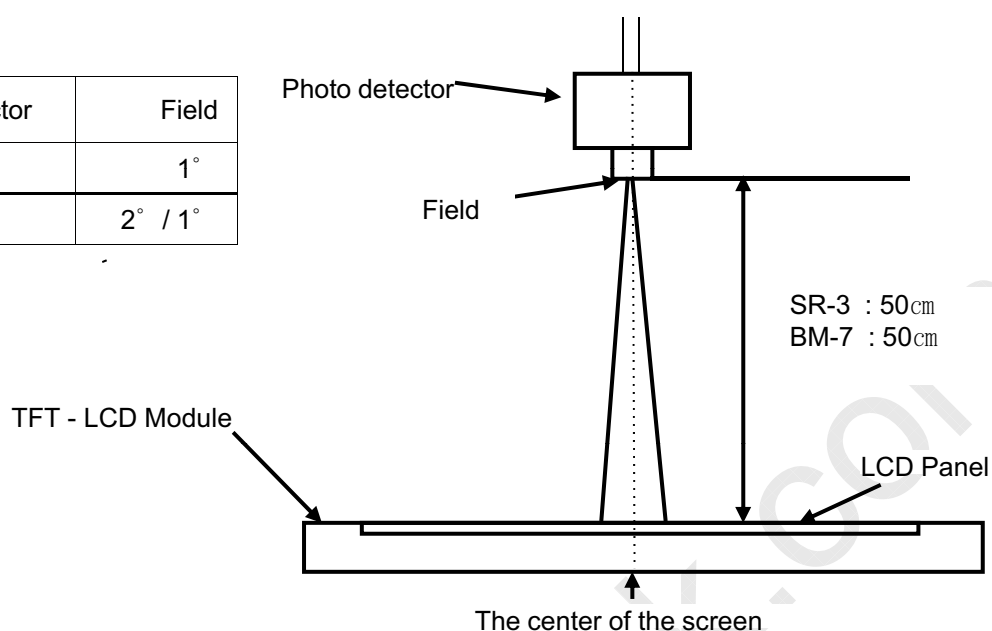
- Definition of test point



|  | 228 | 683 | 1138 |
|---|---|---|---|
| 128 | ⑨ | ⑧ | ⑦ |
| 384 | ⑥ | ⑤ | ④ |
| 640 | ③ | ② | ① |

Active Area

◯ Test Point
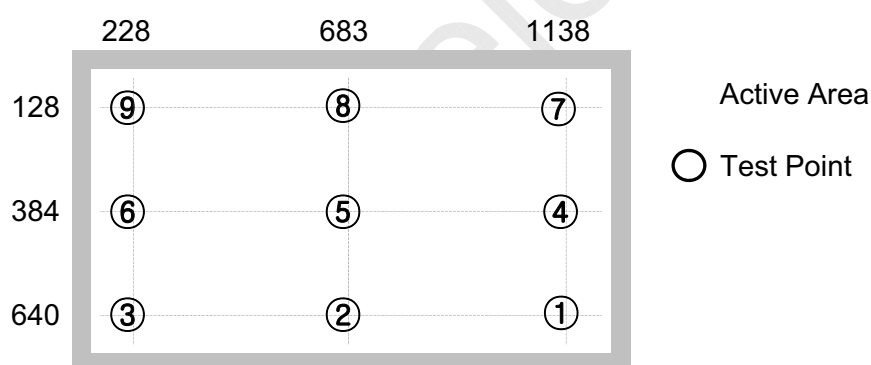
Note (1) Definition of Contrast Ratio (C/R)
: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G\max}{G\min}$$

Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

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Note (2) Definition of 9 points brightness uniformity (Test pattern : Full White )

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness

Note (3) Definition of Response time : Sum of Tr, Tf

Display data    | Black (data off) | White (data on) | Black (data off) |

Optical Instruments Response

$T_R$     $T_F$

100%
90%

10%
0%

TIME
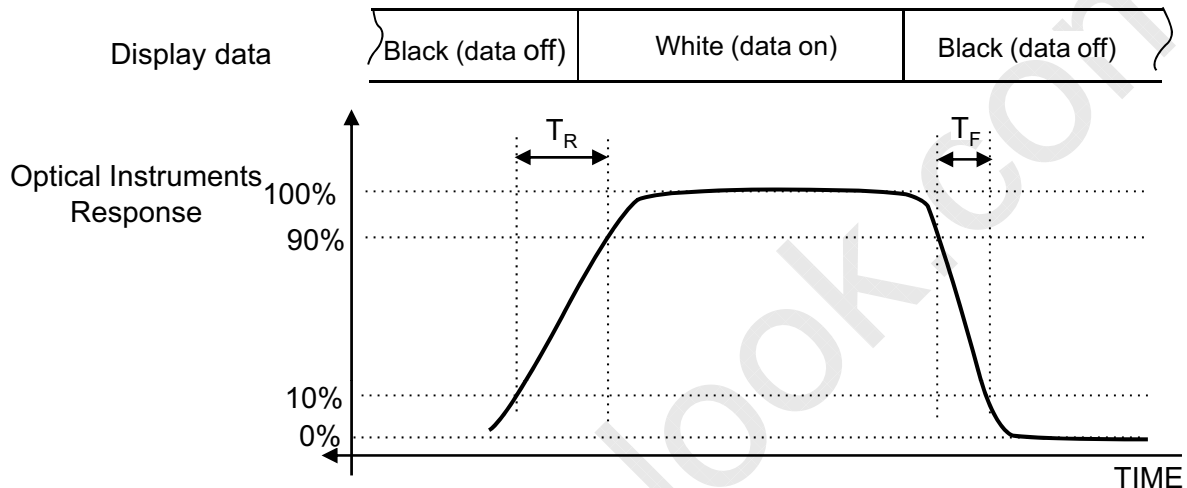
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)
        Color coordinate of Red, Green, Blue & White at center point ⑤

Note (6) Definition of Viewing Angle
        :  Viewing angle range (C/R ≥10)

$\Theta_U$

$\Theta_R$

$\Theta_L$

$\Theta_D$

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## 3. Electrical Characteristics

### 3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C $\pm$ 2 °C

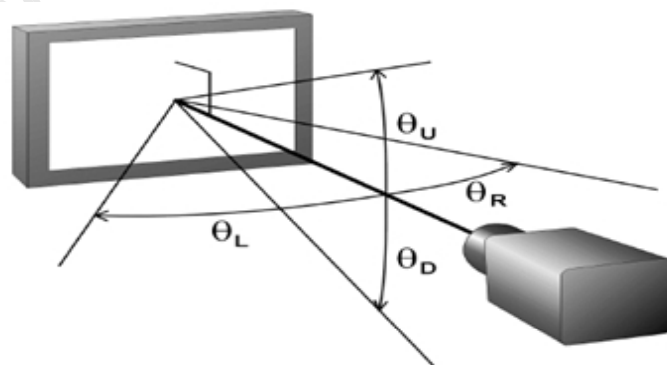| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|------|--|--------|------|------|------|------|------|
| Voltage of Power Supply | | $V_{DD}$ | 10.8 | 12.0 | 13.2 | V | (1) |
| Current of Power Supply | (a) Black | $I_{DD}$ | - | 400 | 500 | mA | (2),(3) |
| | (b) White | | - | 500 | 600 | mA | |
| | (c) V-STRIPE | | - | 600 | 700 | mA | |
| Vsync Frequency | | $f_V$ | 50 | 60 | 66 | Hz | |
| Hsync Frequency | | $f_H$ | 44 | 48 | 53 | kHz | |
| Main Frequency | | $f_{DCLK}$ | 72 | 78 | 85 | MHz | |
| Rush Current | | $I_{RUSH}$ | - | - | 4 | A | (4) |

Note (1 The ripple voltage should be controlled under 10% of $V_{DD}$.

    (2) fV=60Hz,  fDCLK = 75MHz,　 $V_{DD}$  = 12.0V,  DC Current.

    (3) Power dissipation check pattern (LCD Module only)
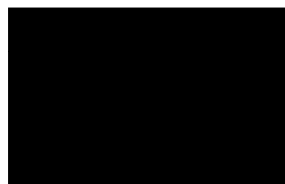
    a) Black Pattern　　　b) White Pattern　　　c) V-STRIPE

(4) Measurement Conditions
(4) Measurement Conditions

100%
90%

10%
GND

$V_{DD}$

$T_{RUSH}$=470$\mu s$
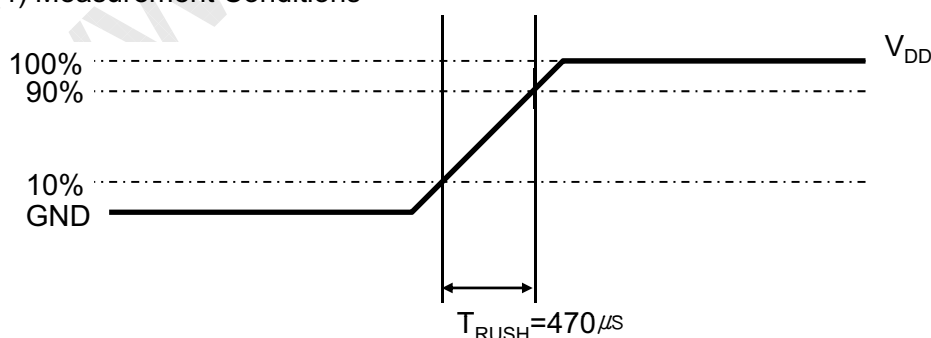
Rush Current $I_{RUSH}$ can be measured when  $T_{RUSH}$. is 470$\mu s$.

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## 3.2  Back Light Unit

The back light unit contains 4 direct-lighting U-type CCFLs ( Cold Cathode  Fluorescent Lamp ). The characteristics of lamps are shown in the following tables.

Ta=25 ± 2°C

**Socket**

HOT 1                                    COLD 1

HOT 2                                    COLD 2

**Inverter**        **LCD Module**

HOT 7                                    COLD 7

HOT 8                                    COLD 8
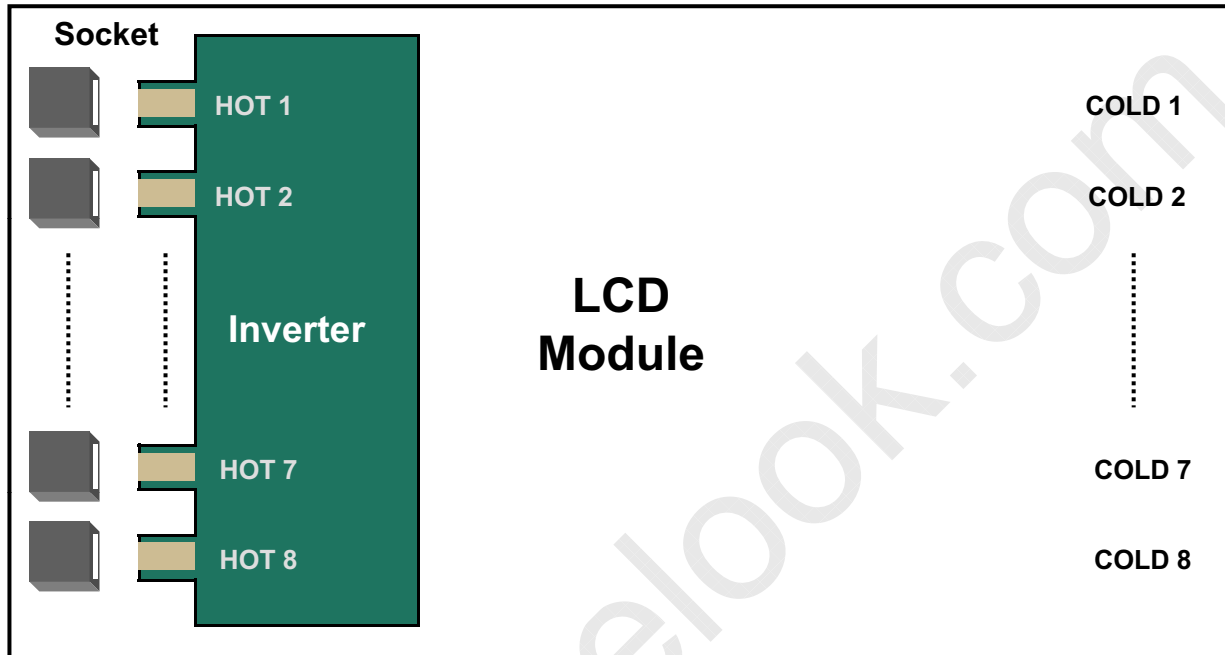
| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Operating Life Time | Hr | 50,000 | - | - | Hour | (1) |

Note (1)  It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition : Ta = 25±2°C, $I_L$ = 5.0 mArms(Min),13.5 mArms  (Max)

For single lamp only. ]

(2) LIPS HOT part

(3) The lamp starting voltage Vs  should be applied to the lamp for more than 1second

under starting up duration. Otherwise the lamp could not be lighted on completed.

## 3.3 Inverter Input Condition & Specification

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| Items | Symbol | Conditions | Specifications | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Input Voltage | Vin | - | 21.6 | 24 | 26.4 | V | Ta=25±2 °C (2) |
| Input Current | $I_{RUSH}$ | Vin=24.0V Vdim =3.3V | - | - | 3.75 | A | (1) |
| Lamp Current | $I_{O,MAX}$ | Vdim =3.3 V | 12.0 | 12.5 | 13.0 | mArms | |
| Backlight On/Off | ON | Vin=24.0 V | 2.4 | - | 5.25 | V | (2) |
| | OFF | Vin=24.0 V | 0 | - | 0.8 | | |
| Dimming Control | $V_{DIM}$ | Max Lum | - | - | 3.3 | V | (2) |
| | | Min. Lum | 0 | - | - | | |
| PWM Frequency | $F_{PWM}$ | Vin=24.0 V | 156 | 166 | 176 | Hz | |
| PWM Duty | Duty | Vin=24.0 V | 20 | - | 100 | % | |

Note) Power Consumption is measured when 450[cd/m$^2$] of luminance which is the typical luminance.
    Lamp Current is measured at the point before Lamp.

(1) Max Value of the Power Consumption is measured during initial turn-on time* of the backlight.

(2) Max Value of the Power Consumption is measured after 120 min warm-up.

(3) Inverter pin NO.12 is for backlight On/Off.

(4) Inverter pin NO.13 is for dimming control.

* Initial turn-on time : From 0sec to 60min after turn-on

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|---|---|---|---|---|---|

## 4. Input Terminal Pin Assignment

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### 4.1. Input Signal & Power                    Connector :IS100-L30O-C23

| PIN No. | Description | PIN No. | Description |
|---------|-------------|---------|-------------|
| 1 | No Connection (Note1) | 16 | GND |
| 2 | No Connection (Note1) | 17 | RxIN3- |
| 3 | No Connection (Note1) | 18 | RxIN3+ |
| 4 | GND | 19 | GND |
| 5 | RxIN0- | 20 | No Connection (Note1) |
| 6 | RxIN0+ | 21 | LVDS OPTION (Note 2) |
| 7 | GND | 22 | No Connection (Note1) |
| 8 | RxIN1- | 23 | GND |
| 9 | RxIN1+ | 24 | GND |
| 10 | GND | 25 | GND |
| 11 | RxIN2- | 26 | Vin |
| 12 | RxIN2+ | 27 | Vin |
| 13 | GND | 28 | Vin |
| 14 | RxCLK- | 29 | Vin |
| 15 | RxCLK+ | 30 | Vin |

Note1) No Connection: **This PINS are only used ONLY for SAMSUNG.**
Note2) LVDS OPTION : If this PIN is HIGH (3.3 V) →  Normal LVDS format
                                            LOW (GND)  →  JEIDA  LVDS format

**SEQUENCE      : On  = V$_{DD}$(T1) ≥ LVDS Option ≥ Interface Signal(T2)**
**OFF =  Interface Signal(T3) ≥ LVDS Option ≥ V$_{DD}$**

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Note(1)  Pin number starts from Left side

PCB

▼

Pin No. 1          Pin No. 30

#1                                         #30

#1                                    #30
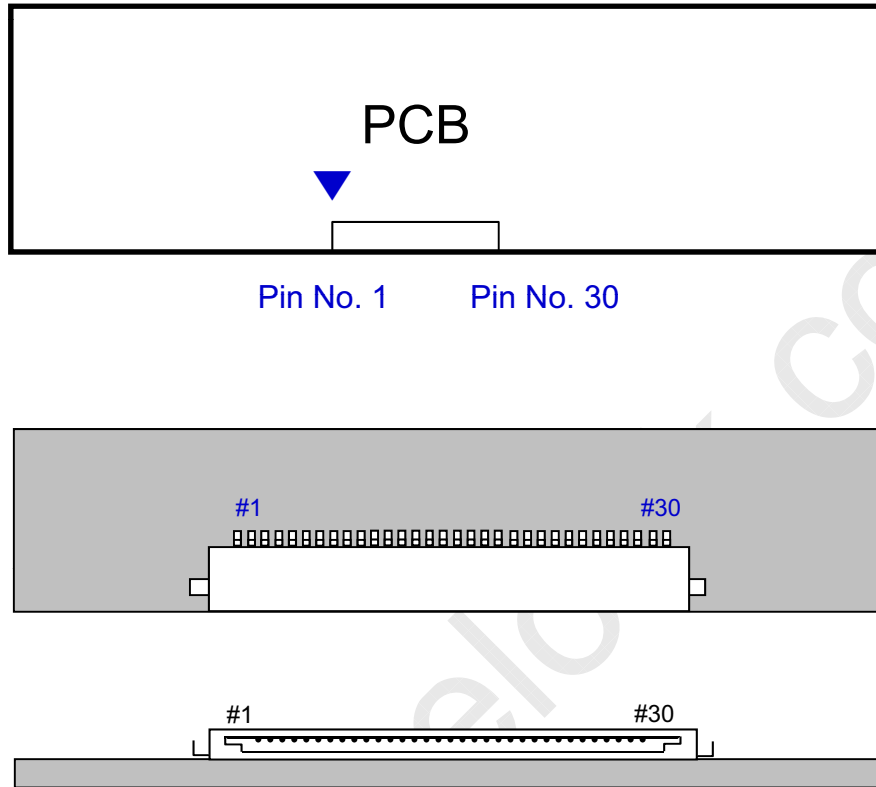
**Fig. Connector diagram**

a. Power GND pins should be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All NC pin should be separated from other signal or power.

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## 4.2. Inverter Input Pin Configuration

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Connector : Yeon-ho, 20022WR-14B1

| Pin No. | Pin Configuration (FUNCTION) |
|---------|------------------------------|
| 1 | Vin (24 V) |
| 2 | Vin (24 V) |
| 3 | Vin (24 V) |
| 4 | Vin (24 V) |
| 5 | Vin (24 V) |
| 6 | GND |
| 7 | GND |
| 8 | GND |
| 9 | GND |
| 10 | GND |
| 11 | **Error_out ( normal : GND, abnormal : open collector)** |
| 12 | Backlight On /Off [ON: 2.4 ~ 5.5 V, OFF: 0 ~ 0.8 V] |
| 13 | Dimming Control [ 0V: Min, 3.3V: Max ] |
| 14 | **No Connection (DO NOT CONNECT)** |

## 4.3. Inverter Input Power Sequence

Vin (24V)
0.9 Vin
0.02sec [Min]
0.1 Vin
0.9 Vin

Dimming Control ( 0 ~ 3.3 V )

0.5sec [Min]
0.5sec [Min]

Backlight On/Off
2.4V(On level)
0.8V(Off level)

0sec [Min]
0sec [Min]

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|-------|-----------|---------|-------------------|------|--------|
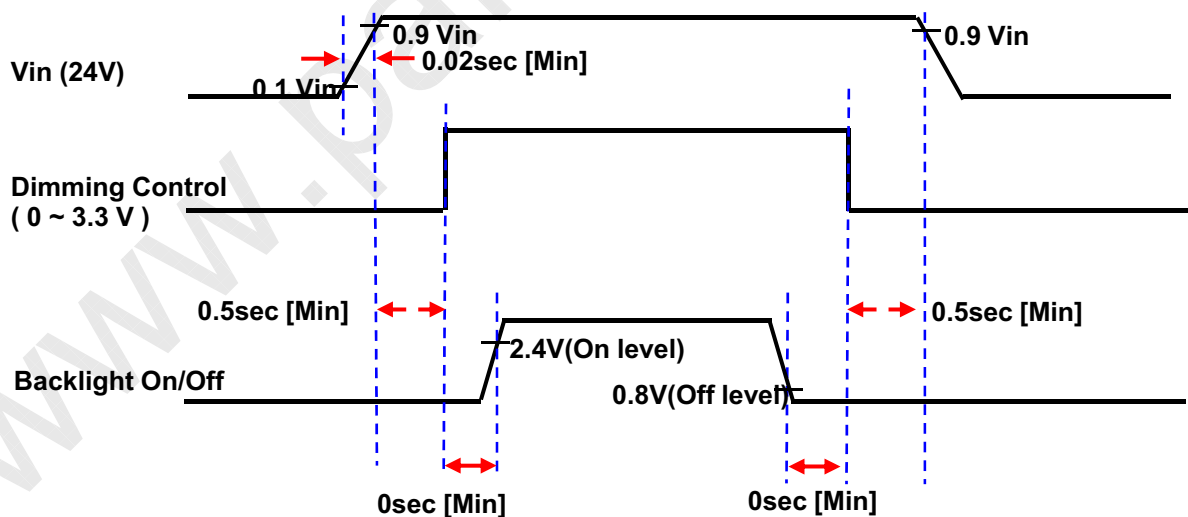
### 4.4  LVDS  Interface
- LVDS Receiver : Tcon (merged)
- Data Format (JEIDA & VESA)

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|  | LVDS pin | JEIDA -DATA | VESA -DATA |
|---|---|---|---|
| TxOUT/RxIN0 | TxIN/RxOUT0 | R2 | R0 |
| | TxIN/RxOUT1 | R3 | R1 |
| | TxIN/RxOUT2 | R4 | R2 |
| | TxIN/RxOUT3 | R5 | R3 |
| | TxIN/RxOUT4 | R6 | R4 |
| | TxIN/RxOUT6 | R7 | R5 |
| | TxIN/RxOUT7 | G2 | G0 |
| TxOUT/RxIN1 | TxIN/RxOUT8 | G3 | G1 |
| | TxIN/RxOUT9 | G4 | G2 |
| | TxIN/RxOUT12 | G5 | G3 |
| | TxIN/RxOUT13 | G6 | G4 |
| | TxIN/RxOUT14 | G7 | G5 |
| | TxIN/RxOUT15 | B2 | B0 |
| | TxIN/RxOUT18 | B3 | B1 |
| TxOUT/RxIN2 | TxIN/RxOUT19 | B4 | B2 |
| | TxIN/RxOUT20 | B5 | B3 |
| | TxIN/RxOUT21 | B6 | B4 |
| | TxIN/RxOUT22 | B7 | B5 |
| | TxIN/RxOUT24 | HSYNC | HSYNC |
| | TxIN/RxOUT25 | VSYNC | VSYNC |
| | TxIN/RxOUT26 | DEN | DEN |
| TxOUT/RxIN3 | TxIN/RxOUT27 | R0 | R6 |
| | TxIN/RxOUT5 | R1 | R7 |
| | TxIN/RxOUT10 | G0 | G6 |
| | TxIN/RxOUT11 | G1 | G7 |
| | TxIN/RxOUT16 | B0 | B6 |
| | TxIN/RxOUT17 | B1 | B7 |
| | TxIN/RxOUT23 | RESERVED | RESERVED |

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|---|---|---|---|---|---|

## 4.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

| COLOR | DISPLAY (8bit) | DATA SIGNAL | | | | | | | | | | | | | | | | | | | | | | | GRAY SCALE LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RED | | | | | | | | GREEN | | | | | | | | BLUE | | | | | | | | |
| | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | |
| BASIC COLOR | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | CYAN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | MAGENTA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | YELLOW | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | WHITE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| GRAY SCALE OF RED | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R0 |
| | DARK ↑ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | R3~ R252 |
| | ↓ | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | LIGHT | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R253 |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R254 |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R255 |
| GRAY SCALE OF GREEN | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | G3~ G252 |
| | ↓ | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G253 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G254 |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G255 |
| GRAY SCALE OF BLUE | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | B3~ B252 |
| | ↓ | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | |
| | LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | B253 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B254 |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B255 |

Note)  Definition of Gray :
   Rn : Red Gray,  Gn : Green Gray,  Bn : Blue Gray (n = Gray level)
   Input Signal :  0 = Low level voltage,  1 = High level voltage

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|---|---|---|---|---|---|

## 5. Interface Timing

### 5.1 Timing Parameters ( DE mode )

| SIGNAL | ITEM | SYMBOL | MIN. | TYP. | MAX. | Unit | NOTE |
|--------|------|--------|------|------|------|------|------|
| Clock | Frequency | $1/T_C$ | 72 | 78 | 85 | MHz | - |
| Hsync | | $F_H$ | 44 | 48 | 53 | KHz | - |
| Vsync | | $F_V$ | 48 | 60 | 66 | Hz | - |
| Vertical Display Term | Active Display Period | $T_{VD}$ | - | 768 | - | Lines | - |
| | Vertical Total | $T_V$ | 780 | 802 | 1200 | Lines | - |
| Horizontal Display Term | Active Display Period | $T_{HD}$ | - | 1366 | - | Clocks | - |
| | Horizontal Total | $T_H$ | 1460 | 1624 | 2000 | clocks | - |

Note) This product is DE only mode. The input of Hsync & Vsync signal does
 not have an effect on normal operation.
(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system
(2) Internal $V_{DD}$ = 3.3V

### 5.2 LVDS Input Data Characteristics

| ITEM | | SYMBOL | Min. | Typ. | Max. | Unit | Note |
|------|--|--------|------|------|------|------|------|
| Input Data Position | Fin=85MHz | $t_{RSRM}$ | - | - | 800 | ps | |
| | | $t_{RSLM}$ | - | - | - | ps | |
| Input common mode voltage | | $V_{CM}$ | 0.3 | - | 2.7 | V | |
| Differential Input Voltage | | $|V_{ID}|$ | 100 | - | 200 | mV | |

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5.2  Timing diagrams of interface signal ( DE mode )

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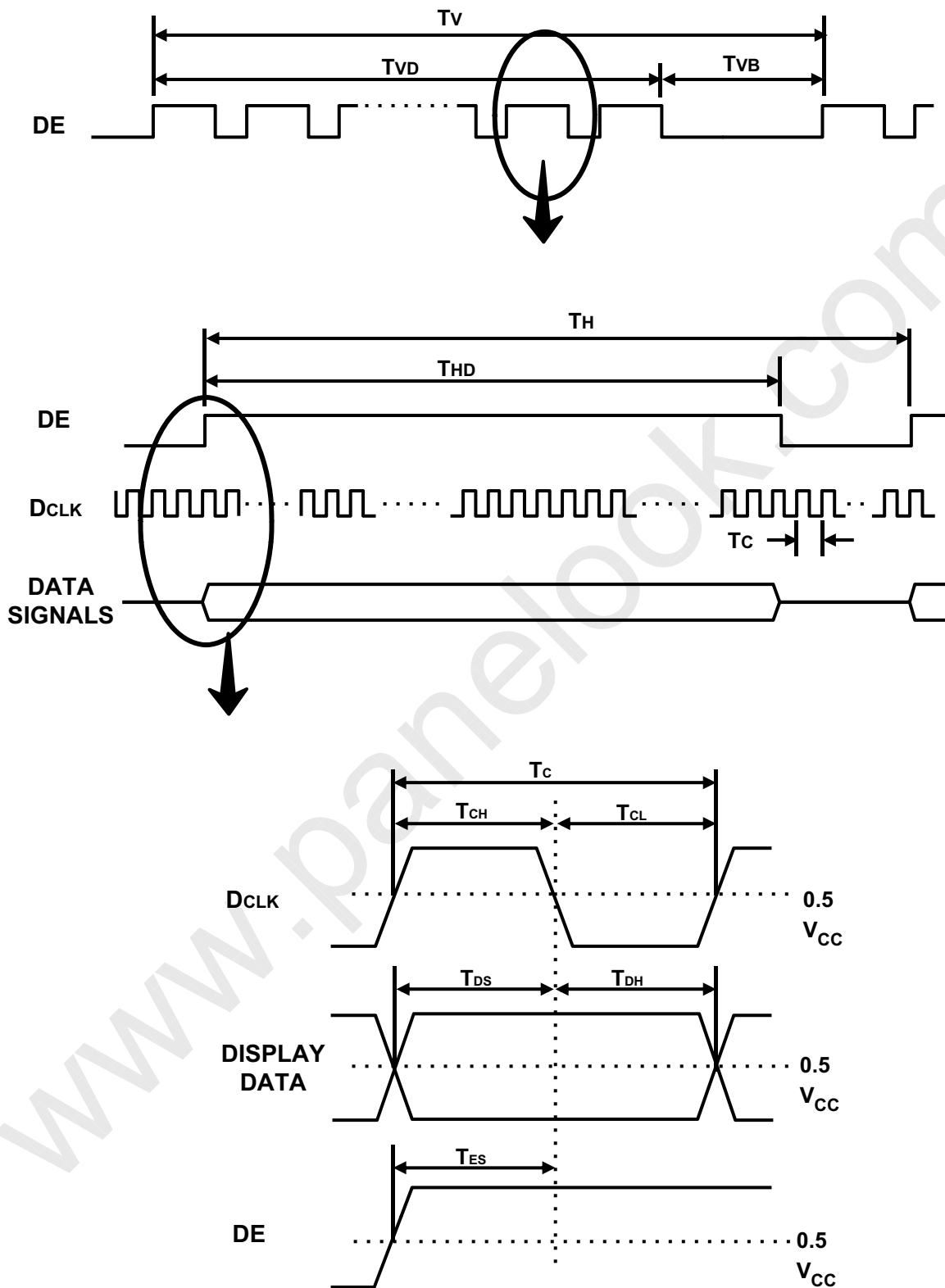
## 5.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



2 msec<T1≤10msec
0<T2≤50msec
0<T3≤50msec
1000msec≤T4

1000msec≤T5
(Recommend Value)
100msec≤T6
(Recommend Value)
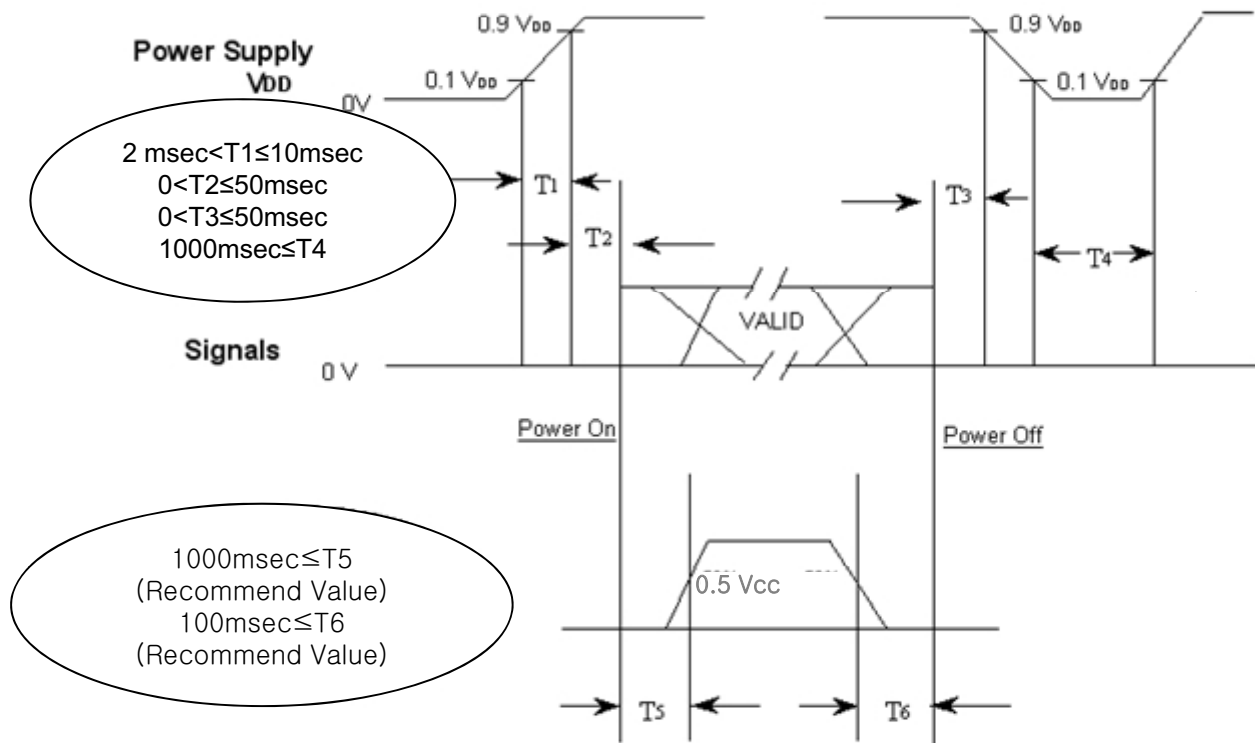
T1 : $V_{DD}$ rising time from 10% to 90%
T2 : The time from $V_{DD}$ to valid data at power ON.
T3 : The time from valid data off to $V_{DD}$ off at power Off.
T4 : $V_{DD}$ off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

§ The supply voltage of the external system for the Module input should be the same as the definition of $V_{DD}$.

§ Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.

§ In case of $V_{DD}$ = off level,
please keep the level of input signals low or keep a high impedance.

§ T4 should be measured after the Module has been fully discharged between power off and on period.

§ Interface signal should not be kept at high impedance when the power is on.

§ In Case T5 is less than 1000msec and T6 is less than 100msec,
Garbage Display can be seen. (It is not related to electrical function issue, Just for recommendation to prevent Garbage Display )

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**6. Outline Dimension**

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|---|---|---|---|---|---|

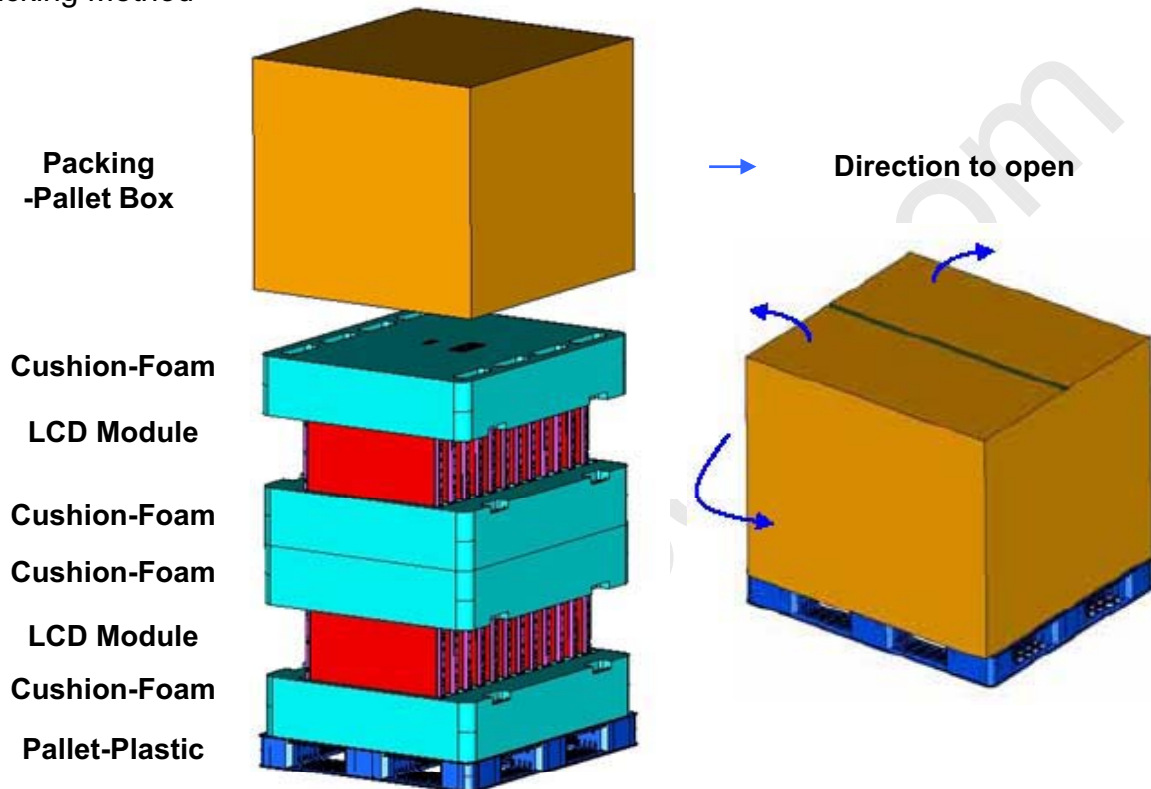| MODEL | LTA320AP05 | Doc. No | 06-001-G-20110328 | Page | 21 /26 |
|-------|-----------|---------|-------------------|------|--------|

# 7. PACKING

## 7.1  CARTON (Internal Package)
  (1) Packing Form
　　Corrugated fiberboard box and corrugated cardboard as shock absorber
  (2) Packing Method

**Packing
-Pallet Box**

→  **Direction to open**

**Cushion-Foam**

**LCD Module**

**Cushion-Foam**

**Cushion-Foam**

**LCD Module**

**Cushion-Foam**

**Pallet-Plastic**

## 7.2 Packing Specification

| ITEM | Specification | Remark |
|---|---|---|
| LCD Packing | 30ea / Box (Packing-Pallet Box) | 1. 6.0kg/LCD(30ea)<br>2. 15kg/Packing-Pallet Box(2ea)<br>3. Box Material : Paper<br>6. Packing Pallet Box Material : DW4 |
| Pallet | 2 Box/Pallet | 1. Pallet Weight : 6kg<br>2. 204kg/Pallet , Total : 216kg |
| Packing Direction | Vertical | 1150 x 850 x 1105 |
| Pallet Size | H x V x Height | 1150mm(H) x 850mm(V) x 125mm(Height) |

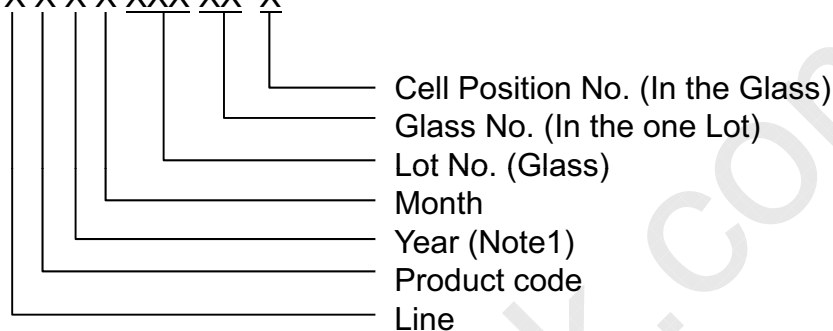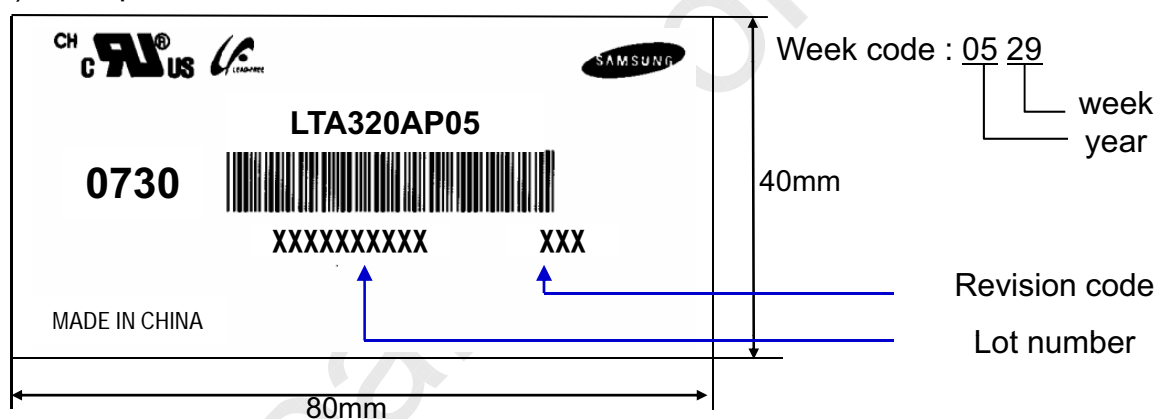| MODEL | LTA320AP05 | Doc. No | 06−001−G−20110328 | Page | 22 /26 |
|---|---|---|---|---|---|

## 8. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Parts number : LTA320AP05
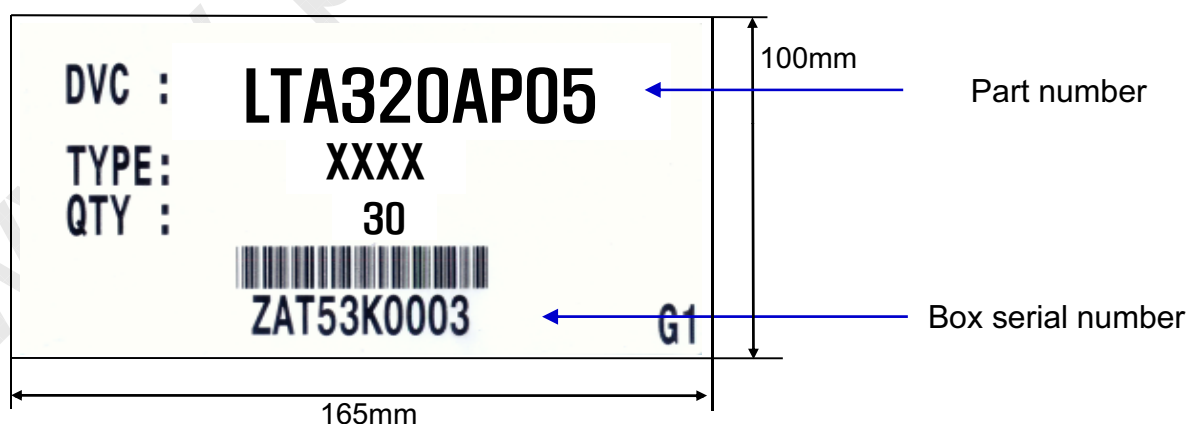(2) Revision:  Three letters
(3) Lot number : X X X X XXX XX  X

Cell Position No. (In the Glass)
Glass No. (In the one Lot)
Lot No. (Glass)
Month
Year (Note1)
Product code
Line

(4) Nameplate Indication

LTA320AP05
0730
XXXXXXXXXX          XXX
MADE IN CHINA

Week code : 05 29
week
year

40mm
80mm

Revision code
Lot number

(5) Packing box attach

DVC : LTA320AP05
TYPE: XXXX
QTY : 30
ZAT53K0003          G1

100mm
165mm

Part number
Box serial number

(6) Others
   1. After service part
       Lamps cannot be replaced because of the narrow bezel structure.

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## 9. General Precautions

9.1 Handling

(a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFL back-light.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static , it may cause damage to the CMOS Gate Array IC.

(i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the lamp wire.

(l) Do not adjust the variable resistor which is located on the module.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

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## 9.2 Storage

(a) Do not leave the module in high temperature, and high humidity for a long time.
　　It is highly recommended to store the module with temperature from 5 to 40　C
　　and  relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or
　　fluorescent  light  during the store.

(d) Storage condition of Packing

| ITEM | UNIT | Min. | Max. |
|------|------|------|------|
| Storage Temperature | (℃) | 5 | 40 |
| Storage Humidity | (%rH) | 35 | 75 |
| Storage Life | 12 months | | |
| Storage Condition | -Prohibit direct sunlight<br>-Ventilation in storehouse and control changing temperature is within limits of environment<br>-Put it on pallet and store them with removing from wall.<br>-Don't wet Out-BOX and avoid rain.<br>-Without condensation.<br>-Etc. Avoid harmful Condition | | |
| Long-term Storage Process | -More than 3 months Storage or Low temp. Delivery/under  5℃ storage<br>→On the 20℃,50%rH Condition, more than 10hr release. | | |

## 9.3 Operation

(a) Do not connect or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off  by the "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic
　　interference should be done by system manufacturers. Grounding and shielding methods
　　may be important to minimize the interference.

(d) The cable between the back light connector and its inverter power supply should
　　be connected directly with a minimized length. A longer cable between
　　the back light and the inverter may cause lower luminance of lamp(CCFT) and
　　may require higher startup voltage(Vs).

## 9.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : $20\pm15℃$
- Humidity : $55\pm20\%$
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

## 9.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. ( supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.

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